

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Yair Ein-Eli et al.

Serial No.: 10/551,714

Filed: July 20, 2006

For: COPPER CMP SLURRY
COMPOSITION

Examiner: PARVINI, Pegah

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Confirmation No. 6188

Group Art Unit: 1793

Attorney Docket: 30579

For interview
at 10:00 AM
today (Telephone)

DRAFT RESPONSE BEFORE INTERVIEW**DO NOT ENTER INTO RECORDS**

Attending interview
- Martin Meyerhan
- Revital Goren

Sir,

This is in response to the United States Patent and Trademark Office Action mailed May 13, 2010, which response is being made on or before November 13, 2010, and for which a three-months extension of time fee is due and is submitted herewith.

Applicant submits this response for entry into the record, in which:

Amendments to the Claims begin on page 2.**Remarks** begin on page 10.

Please amend the above-identified application as follows:

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In the claims:

Please amend the claims as follows:

1. (Previously presented) A composition ~~useful for the formation of a passivating layer on a surface, the surface including more than 5% copper by weight, the composition comprising a solution which has a pH that ranges from 9 to 13 and being devoid of a film-forming agent, a copper complexing agent and ammonium cations, the composition is being such that when it is applied to a surface which includes more than 5 % copper by weight, it oxidizes having an oxidation potential sufficient to oxidize the surface copper to form copper oxides and being devoid of a film-forming agent, a copper complexing agent and ammonium cations, wherein neither said copper nor said copper oxides are soluble in the composition, the composition being useful for the formation of a passivating layer on a surface.~~

2. (Previously presented) The composition of claim 1, wherein the surface includes more than 10% copper by weight.

3. (Previously presented) The composition of claim 1, wherein the surface includes more than 20% copper by weight.

4. (Previously presented) The composition of claim 1, wherein the surface includes more than 40% copper by weight.

5. (Previously presented) The composition of claim 1, wherein the surface includes more than 50% copper by weight.

6. (Previously presented) The composition of claim 1, wherein the surface includes more than 80% copper by weight.

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REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-22 and 26-59, drawn to a composition useful for the formation of a passivating layer on a substrate, have been examined on the merits. Claims 31-52 and 54 have been withdrawn from further consideration as being drawn to a non-elected invention. Claims 23-25 have been previously canceled. Claims 1-22, 26-30, 53 and 55-59 have been examined on the merits.

Claims 1-22, 26-30, 53 and 55-59 have been rejected under 35 U.S.C. § 103. Claim 1 has been amended herewith.

Points to be discussed during the interview

Amendment to the claims

Applicant submits herewith a proposed amendment to the claims, in which claim 1 has been amended so as to better define the claimed composition. Amended claim 1 reads on a composition that comprises a solution having a pH that ranges from 9 to 13, which, when applied to a copper-containing surface, oxidizes the copper to copper oxides such that neither the copper nor the copper oxides are soluble in the composition.

As argued hereinbelow, it is submitted that none of the cited art teach compositions which are characterized by the claimed features.

35 USC § 103 rejections

Shimazu et al. ('064), Shimazu et al. ('188) and

Francis et al.

The Examiner has stated that claims 1-9, 12-17, 19-22, 26-30, 53, and 55-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2002/0117064 to Shimazu et al. ('064) and U.S. Patent Application Publication No. 2003/0153188 Shimazu et al. ('188).

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The Examiner has further stated that claims 1-19, 26-30, 53, 55-57 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2001/0051433 to Francis *et al.*

The Examiner's rejections are respectfully traversed. Claim 1 has been amended herewith.

Re.: Overlapping range

The Examiner has stated that that Shimazu *et al.* disclose a polishing composition having a pH of 5.5-10.0 and containing alkaline substances such as potassium carbonate, oxidizing agent such as potassium permanganate, abrasive grains such as silicon oxide, aluminum oxide, cerium oxide in an amount of preferably 0.1-20 or 1.0-10 weight percents. The Examiner further stated that it is to be noted that a pH of 5.5-10 clearly has overlapping ranges with the claimed pH (9 to 13), and overlapping ranges have been held to establish *prima facie* obviousness.

With respect to Francis *et al.*, the Examiner has stated that Francis *et al.* disclose a chemical mechanical polishing solution having a pH of preferably greater than 9.0, at least one abrasive such as alumina, silica, ceria in an amount of from about 1.0 to about 50.0 weight percent, preferably from about 5.0 to about 25.0 wt%, and further comprising at least one Cs+ basic salt such as cesium carbonate, and optional components such as oxidizing agents. The Examiner further stated that a pH of preferably greater than 9.0 clearly has overlapping ranges with the claimed pH, and overlapping ranges have been held to establish *prima facie* obviousness.

In both cases, The Examiner has quoted MPEP § 2144.05.

Applicant argues that the Shimazu *et al.* references are directed at providing compositions that exhibit a high rate of polishing Ta or TaN material (see, paragraph [0021]) and a relatively lower rate of copper dissolution, in order to remove a barrier layer while trying to minimize the effect on copper nanowires. Shimazu *et al.* report to have carried out extensive studies so as to avoid copper erosion, and to have found that a polishing composition having a pH of 5.5-10.0, and more preferably 5.5-9.0, excellent performance for polishing Ta or TaN material in LSI devices (see, paragraphs [0022-0023]). Shimazu *et al.* further disclose that a composition having a pH of 5.5-10.0, and more preferably 5.5-9.0, exhibits considerably low corrosiveness

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and dissolution of copper (see, paragraph [0025]). The Shimazu *et al.* references thus teach that the dissolution rate of copper at the indicated pH range is low, yet dissolution occurs. Furthermore, while the Shimazu *et al.* references teach a pH range of 5.5-10.0, all the data demonstrated therein relates to pH of 7.0-9.0, and no experiments were actually performed at pH higher than 9.0.

Applicant have already argued in detail, in response to previous office actions, that the instant application presents and discusses in details the rational behind using a composition for polishing copper having a pH that ranges from 9 to 13, based on the non-trivial finding that below that pH range or above it the polishing composition is less effective due to copper or copper oxide dissolution which occurs outside that pH range.

With reference to MPEP § 2144.05, Applicant respectfully submits that it is stated therein when the claimed range is shown to be critical and achieves unexpected results relative to the prior art range there is no prima facie case of obviousness.

Applicant contends that the instant application contains ample description and results to back the contention that the pH range of the claimed composition is indeed critical to obtain the desired result. The Examiner's attention is kindly drawn in this regard to the passage on page 10, line 17-21, which opens the discussion on the underlining rational of the presently claimed CMP slurries. This passage speaks of the non-obvious analysis of the Pourbaix diagram (a potential/pH diagram) presented in Figure 1 of the instant application, which maps out possible stable (equilibrium) phases of an aqueous electrochemical system of copper and other metals. The passage on page 10, lines 22-28 presents the connection between the pH of the system containing copper, and the sufficient oxidation potential for passivation of copper, which is then expressed by the equation presented on page 11, line 9, of the instant application.

In summary, while the Shimazu *et al.* documents are explicit in teaching a composition having a preferred pH in the range of 5.5-9, and in teaching that dissolution of copper occurs at that pH range, the instant application discloses a CMP composition for copper, and provides the unexpected evidence to the contrary, showing that a composition having a pH in the range of 5.5-9 will not afford the desired lack of copper dissolution while the claimed pH range do.

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With respect to Francis *et al.*, Applicant's arguments follow the aforementioned arguments. Specifically, Applicant submits that Francis *et al.* is directed at compositions for polishing silicon wafers, and disclose that the pH of the polishing composition should be greater than about 7.0 and preferably greater than about 9.0. Since this reference is not directed at CMP compositions for copper, Francis *et al.* are completely silent with respect to the problem of copper dissolution or to the reasons to limit the pH to the range of 9 to 13, as disclosed in the instant application, and is silent with respect to the criticality of the claimed pH range for achieving the desired results.

Re.: Recitation in the preamble

With respect to both Shimazu *et al.* and Francis *et al.*, the Examiner has stated that the recitation of "for the formation of a passivating layer on a surface, the surface including more than 5 % copper by weight" is a recitation in the preamble, and quoted MPEP § 2111.02.

Applicant submits that in the MPEP § 2111.02 it is recited that:

"If the claim preamble, when read in the context of the entire claim, recites limitations of the claim, or, if the claim preamble is 'necessary to give life, meaning, and vitality' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165-66 (Fed. Cir. 1999)."

and

"During examination, statements in the preamble reciting the purpose or intended use of the claimed invention must be evaluated to determine whether the recited purpose or intended use results in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the

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prior art. If so, the recitation serves to limit the claim. See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963)."

Applicant contends that, as argued in detail hereinabove, since the claimed pH range of the composition achieves results with respect to copper dissolution, which are unexpected over the teachings of the Shimazu *et al.* documents and of Francis *et al.*, it is clear that the recitation in the preamble is at least "necessary to give life, meaning, and vitality" to the claim".

Notwithstanding the above, it is submitted that amended claim 1, as presented herein, more clearly defines the effect of the claimed composition in the context of the indicated recitation,

Respectfully submitted,

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Date: October 20, 2010